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(1, 2, 3), F. S. Woods (1, 2, 3), J. W. A. Young (1, 2, 3) [Math., Pedagogy of math.], J. W. Young (2, 3), A. Ziwet (1, 2, 3) [Math., Mech.].

Fourteen names in this list are followed by brackets [] enclosing the names of different fields of work, but mathematics coming first. The following 10 names are of others in connection with whom mathematics does not come first or else the subject is mathematical astronomy or mathematical physics:

J. G. Coffin (2, 3) [Mathematical physics], C. L. Doolittle (1, 2; d. 1919) [Ast., Math.], J. R. Eastman (1, 2; d. 1913) [Ast., Math.], G. W. Hill (1, 2; d. 1914) [Mathematical astronomy], F. H. Loud (1, 2, 3) [Ast., Math.], A. Macfarlane (1, 2; d. 1913) [Mathematical physics], R. C. Maclaurin (2; d. 1920) [Mathematical physics], B. O. Peirce (1, 2; d. 1914) [Mathematical physics], F. Slate (1, 2, 3) [Mathematical physics], J. B. Webb (1, 2; d. 19 ?) [Physics, Math.].

On pages 771-780 is given a very useful list of 1059 American men of science who died between January 1, 1903, and December 31, 1920. The years of birth and death are appended in each case where it was possible to determine such dates. The list includes not only the names of those whose names appeared in earlier editions, but also of others such as of G. M. Green. Certain events of very recent occurrence are recorded in the volume; for example, the death of A. Pell, January 26, 1921, and the appointment of J. R. Angell as president of Yale. It is not clear to the reviewer why a sketch of W. G. Everett, whose subject is ethics, should appear in the third edition.

Everyone interested in American science will wish to have this new *Biographical Directory* constantly at hand.

R. C. ARCHIBALD.

NOTES.

School Arithmetics is the title of a work, for grades I-VIII, by G. WENTWORTH and D. E. SMITH. (3 books, Boston, Ginn, 1920. 12mo. 6 + 282 + 16; 6 + 298 + 19; 6 + 346 + 19 pp. Price 72 + 76 + 92 cents.)

Professor J. H. M. WEDDERBURN's article "On equations of motion of a single particle," published separately January 24, 1921, appeared in part 1 (May), volume 41 (pp. 26-33), of *Proceedings of the Royal Society of Edinburgh*.

In *Popular Astronomy*, June-July, 1921, there is a reproduction of a photograph, taken on May 6, 1921, of a group with Professor Einstein at the Yerkes Observatory. Professor A. C. LUNN, of the University of Chicago, is a member of the group.

Comptes Rendus du Congrès International des Mathématiciens à Strasbourg, was published November 1, 1921, by Imprimerie Edouard Privat, Toulouse (paper, 100 francs; cloth, 125 francs).

In *Proceedings of the London Mathematical Society*, second series, volume 20, August 20, 1921, there is an article "Arithmetic of quaternions" by L. E. DICKSON. Compare 1921, 289.

The last number of *Mathematische Annalen*, volume 80, has been published (see 1921, 219). It is a General register to volumes 51–80 and has a preface by H. VERMEIL. There is a portrait frontispiece of C. Neumann.

The third edition of W. F. Osgood's *Lehrbuch der Funktionentheorie*, volume 1, published by Teubner in 1920, is an anastatic reprint, the only textual changes of the second edition being in connection with the correction of a few misprints. The paper and general appearance are inferior and the volume is only about half as thick.

In the recently published *Washington University Studies*, volume 8, no. 2, the following papers are included: "The curve which with its caustic encloses the minimum area" (cf. this MONTHLY, 1920, 225) by OTTO DUNKEL, 183–194; and "Brilliant point phenomena" (cf. this MONTHLY, 1913, 299; 1919, 111) by W. H. ROEVER, 131–159 + 4 plates.

Abhandlungen aus dem mathematischen Seminar der Hamburger Universität is the title of one of the nine new mathematical periodicals founded in 1921. The editors are W. BLASCHKE, E. HECKE and J. RADON. The first number (98 pages, price 25 marks) was published in September (Hamburg, Otto Meissner). It contains six memoirs by the following authors: W. Blaschke, E. Hecke, A. Ostrowski, J. Radon, K. Reidemeister, and P. Steinhagen.

We have previously noticed the *Tables of the Digamma and Trigamma Functions* by Miss ELEANOR PAIRMAN (1921, 265–266). During the summer of 1921 she completed the work for a doctorate at Harvard University, her thesis being entitled: "Expansion theorems for solutions of a Fredholm linear homogeneous integral equation of the second kind with kernel of special non-symmetric type."

A volume supplementary to *Œuvres de Fermat*, tomes I–IV, is being prepared—Heath, of New York, announces as in the press *Projective Geometry* by R. M. WINGER, of the University of Washington, and *Trigonometry, Plane and Spherical* by J. A. BULLARD and ARTHUR KIERNAN, of the United States Naval Academy—Wiley, of New York, published, in December, 1921, *First Course in the Theory of Equations* by L. E. DICKSON (171 pages; \$1.75)—Macmillan of New York has published *Mathematics for Students of Agriculture* by S. E. RASOR.

The number of *L'Enseignement Mathématique*, published in July, 1921, contains a complete list of the publications of the International Commission on the Teaching of Mathematics. This list gives references to 310 reports published in 187 fascicules or volumes, and totalling 13,565 pages. To this total Germany contributed 5,571 pages, the United States coming next with 1,499 pages, then Great Britain with 921, Japan with 788, Switzerland with 781, Austria with 776, and similarly for twelve other countries down to Argentina with 24 pages and Roumania with 16. Among other indexes, an alphabetical list of authors is appended to the list.

In notes on perfect numbers, we have indicated (1921, 140-141) that the Mersenne numbers, $p = 2^n - 1$, are prime for $n = 2, 3, 5, 7, 13, 17, 19, 31, 61, 89, 107$, and 127 ; that it was not known whether p was prime or composite for $n = 137, 139, 149, 157, 167, 193, 199, 227, 229, 241$, and 257 ; and that for all other values of $n < 257$, p was composite. A. Gérardin has indicated a method (*Comptes rendus du Congrès des Sociétés Savantes en 1920*, Sciences, pp. 53-55) showing that p is composite for $n = 137$. Hence there are now only 10 doubtful cases, $n < 257$, in connection with the Mersenne numbers.

Among parts of *Encyklopädie der mathematischen Wissenschaften* published in 1921 are the following: (a) II, 3, 4—"Neuere Untersuchungen über Funktionen von komplexen Variablen" by L. Bieberbach, 379-532 (22 marks); (b) III, 1, 6—"Elementargeometrie und elementare nichteuklidische Geometrie in synthetischer Behandlung" (Teil 2, Schluss) by M. Zacharias, 963-1172 (23.75 marks); (c) III, 1, 7—"Neuere Dreiecksgeometrie" by G. Berkhan and F. Meyer, and "Systeme geometrischer Analyse" by H. Rothe, 1173-1423 (30.80 marks); (d) III, 2, 7—"Mehrdimensionale Räume" by G. Segre, 769-972 (22 marks); (e) III, 3, 5—"Dreifach orthogonale Flächensysteme" by E. Salkowski, 541-606 (9.70 marks); (f) II, 2, 5—"Nichtlineare Differentialgleichungen" by E. Hilb, and "Abelsche Funktionen und allgemeine Thetafunktionen" by W. Wirtinger, and Titel, Inhaltsverzeichnis und Register zu Band II, 2, 563-897 (49.30 marks); (g) II, 3, 5—"Arithmetische Theorie der algebraischen Funktionen zweier unabhängigen Veränderlichen" by H. W. E. Jung, 533-674; (h) V, 1, 6—"Physikalische- und Elektrochemie" by K. F. Herzfeld and Titel und Inhaltsverzeichnis zu Band V, 1, 947-1112 + 20 (30 marks); (i) V, 2, 4—"Relativitätstheorie" by W. Pauli, Jr., 539-775 (36 marks).

The first number (80 pages, sm. 4to) of a new periodical, *Zeitschrift für angewandte Mathematik und Mechanik*, was published in February, 1921, by the Verlag des Vereines Deutscher Ingenieure, Berlin (Price, in Germany, 50 marks; to members of the Deutsche Mathematiker-Vereinigung in America, 72 marks a year for the six numbers). The periodical is edited by R. von Mises with the assistance of A. Föppl, G. Hamel, R. Mollier, H. Müller, L. Prandtl, and R. Rüdénberg. The first number opens with an article by the editor: "Zur Einführung, Ueber die Aufgaben und Ziele der angewandten Mathematik" (pp. 1-15). This is followed by a variety of material under the headings: Principal papers, Comprehensive reports, Short abstracts, Book-reviews, Short notices, and News.

Journal of Mathematics and Physics of the Massachusetts Institute of Technology is the title of a new periodical, the first number of which was published in November, 1921 (The Murray Printing Co., Cambridge, Mass.). The editors are F. S. WOODS (professor of mathematics), H. M. GOODWIN (professor of physics and electro-chemistry), and F. G. KEYES (professor of physico-chemical research); the managing editor is C. L. E. MOORE (professor of mathematics). A volume

of 200–250 pages (price \$3.00) consisting of three or four numbers will probably be published each year. The contents of the current number are: “A new vector method in integral equations” by F. L. Hitchcock and Norbert Wiener, 1–20; “On the geometry of motion in curved n -space” by Joseph Lipka, 21–41; “The equation of state, with applications to viscosity” by H. B. Phillips, 42–53; “Some hydrodynamic aspects of group theory” by S. D. Zeldin, 54–62.

Among the articles in the concluding number of *Jahresbericht der Deutschen Mathematiker-Vereinigung*, 1920, are the following: “Zur Biographie Johann Bolyais” by S. Wiener, 130–135 [new material concerning one of the founders of non-euclidean geometry while he was at the academy for engineers, and in military service]; “Die relative und absolute Bewegung bei Huygens” by J. A. Schouten, 136–144 [interesting for students of the history of relativity]; “Jan Versluys” by L. Schlesinger, 236–237 [Netherland mathematician, born 1845, died January 15, 1920. Among his publications listed by Schlesinger are five prize memoirs, crowned by the Mathematical Society of Amsterdam, and numerous books, some of which were widely used in schools of the Netherlands. Among his books are: *Leerboek der Stereometrie*, *Handboek der Meetkunde*, *Methoden bij het oplossen van Meetkundige Vraagstukken*, *Isometrie en Axonometrie*, *Inleiding tot de nieuwere Meetkunde van den driehoek*, and *Zes en negentij bewijzen voor het theorema van Pythagoras*. There are many books by Versluys not listed by Schlesinger].

In the new volume of the great *Encyclopædia of Religion and Ethics*, edited by James Hastings (volume XI, Sacrifice–Sudra, Edinburgh, T. & T. Black, 1921), there are articles (1) on “Science” by J. A. Thomson, regius professor of natural history at the University of Aberdeen (pages 252–261); and (2) on “Space” by G. J. Stokes, professor of philosophy and jurisprudence in University College, Cork, Ireland (pages 759–764). The sub-headings for (1) are: Definition and characteristics, aim of science, the scientific mood, the methods of science, scope of science, classification of sciences, correlation of sciences, limitations of science, science and feeling, science and philosophy, and science and religion. For (2) the sub-headings are: History, (a) Greek philosophy, (b) middle ages, (c) Cartesian and English philosophy, (d) Kant; Laws of thought and the concept of space. The article concludes with an acknowledged extract of three paragraphs from Professor Stokes’s article, “The theory of mathematical inference,” contributed to this MONTHLY, 1900, 1–8.

While the last part of *Acta Mathematica*, volume 42, appeared before the close of 1920, no part of volumes 38 and 39 had then been distributed. The first of these volumes, in memory of Henri Poincaré, has now been published. It is a volume of 402 pages (price 50 Swedish kronor; on extra fine, thick, strong paper, 75 kronor). The contents are as follows: “Au lecteur,” pages 1–2; “Henri Poincaré, Analyse de ses travaux scientifiques,” 3–135 [revised by the author];

"Rapport sur les travaux de M. Cartan" by H. Poincaré, 137-145; "Lettres à M. Mittag-Leffler" by H. Poincaré, 147-160; "Lettres à M. Mittag-Leffler concernant le mémoire couronné du prix de S. M. le roi Oscar II" by H. Poincaré, 161-173; "Lettres à L. Fuchs" by H. Poincaré, 175-184; "Briefe an H. Poincaré" by L. Fuchs, 185-187; "Henri Poincaré, en mathématiques spéciales à Nancy" by P. Appell, 189-195; "Lettres à M. Mittag-Leffler" by P. Boutroux, 197-201; "L'œuvre mathématique de Poincaré" by J. Hadamard, 203-287; "Die Bedeutung Henri Poincaré's für die Physik" by W. Wien, 289-291; "Deux mémoires de Henri Poincaré sur la physique mathématique" by H. A. Lorenz, 293-308; "L'œuvre astronomique d'Henri Poincaré" by H. v. Zeipel, 309-385; "Henri Poincaré und die Quanten-theorie," 387-397; "Henri Poincaré" by P. Painlevé, 399-402.

"Anaximander's Book, the Earliest Known Geographical Treatise" is the title of an interesting fifty-page monograph, by W. A. HEIDEL, professor of Greek in Wesleyan University, published in *Proceedings of the American Academy of Arts and Sciences*, April, 1921. The mathematician will naturally wish to read collaterally what Sir Thomas Heath records concerning Anaximander in numerous passages of his *Aristarchus of Samos* (Oxford, 1913). From this latter source the following paragraphs, stripped of foot-note references, are extracted (pages 38-39):

"The story that Anaximander was the first to discover the *gnomon* (or sun-dial with a vertical needle) is incorrect, for Herodotos says that the Greeks learnt the use of the *gnomon* and the *polos* from the Babylonians. Anaximander may, however, have been the first to 'introduce' or make known the *gnomon* in Greece, and to show on it 'the solstices, the times, the seasons, and the equinox.' He is said to have set it up in Sparta. He is also credited with constructing a sphere to represent the heavens, as was Thales before him.

"But Anaximander has yet another claim to undying fame. He was the first who ventured to draw a map of the inhabited earth. The Egyptians had drawn maps before, but only of particular districts; Anaximander boldly planned out the whole world with 'the circumference of the earth and of the sea.' Hecataeus, a much-travelled man, is said to have corrected Anaximander's map, so that it became the object of general admiration. According to another account, Hecataeus left a written description of the world based on the map. In the preparation of the map Anaximander would of course take account of all the information which reached his Ionian home as the result of the many journeys by land and sea undertaken from that starting-point, journeys which extended to the limits of the then-known world; the work involved of course an attempt to estimate the dimensions of the earth. We have, however, no information as to his results."

Periodical Bibliographies and Abstracts for the Scientific and Technological Journals of the World is the title of a *Bulletin* (pages 131-154) published by the National Research Council in June, 1920. If ignorance of the subject in question is as glaringly in evidence in other topics as it is in connection with mathematics (page 145), the Council had been better advised to have withheld the manuscript of its *Bulletin* until it had been properly prepared—*Funds Available in 1920 in the United States for the Encouragement of Scientific Research* is the subject of an interesting 81-page *Bulletin* of the Research Council published in March, 1921. The grant of \$25,000 from the General Education Board to the Mathematical Association of America is noted. Under the heading of "Mathematics" reference

is made also to the Sylvester prize of Johns Hopkins University, to the J. S. K. mathematical fellowship of Princeton University, and to the resident research fellowship in mathematics of Bryn Mawr College. Under the heading of "Science" there is a long list of medals and prizes, grants, institutional funds, and fellowships and scholarships, which are unrestricted in award. We have already referred to the Heckscher Foundation here listed, and to awards made from it for research in mathematics (1921, 287-288).

Among books published in 1921 are the following: *Theoretical Mechanics: An Introductory Treatise on the Principles of Dynamics* by A. E. H. LOVE (Third edition, Cambridge University Press; 15 + 310 pages; price 30 shillings)—*Elements of the Mathematical Theory of Electricity and Magnetism* by J. J. THOMSON (Fifth edition, Cambridge University Press; 410 pages; price 25 shillings)—*A Treatise on the Integral Calculus, with Applications, Examples, and Problems* by J. EDWARDS (London, Macmillan; volume 1, 907 pages; price 50 shillings)—*The Reign of Relativity* by Viscount HALDANE (London, Murray; 23 + 430 pages; price 21 shillings)—*A First Course in Statistics* by D. C. JONES (London, Bell; 9 + 286 pages; price 15 shillings)—*Des fondements de la géométrie* by H. POINCARÉ (Bibliothèque de synthèse scientifique. Paris, E. Chiron; 65 pages; price 3 francs)—*Theorie der reellen Funktionen* by H. HAHN (Berlin, Springer; volume 1, 4 + 600 pages; price 136 marks to Germans)—*Vorlesungen über Zahlen- und Funktionenlehre* by A. PRINGSHEIM. Band I: *Zahlenlehre* (Leipzig, Teubner, 3. [Schluss-] Abteilung¹—*Komplexe Zahlen, Rechnen mit komplexen Gliedern*; price 175.00 marks to Germans)—*Vorlesungen über algebraische Geometrie* by F. SEVERI. Deutsch von E. Löffler (Leipzig, Teubner; 408 pages; price, unbound, 92.40 marks). Mathematisch-physikalische Bibliothek (Leipzig, Teubner, price of each, boards, 5.30 marks): no. 40, P. KIRSCHBERGER, *Mathematische Streifzüge durch die Geschichte der Astronomie* (54 pages); no. 42, A. WITTING, *Einführung in die Infinitesimalrechnung* 2. Auflage, II: *Die Integralrechnung* (50 pages)—*Gruppentheorie* by L. BAUMGARTNER (Sammlung Götschen, Berlin, Vereinigung wissenschaftlicher Verleger; 120 pages; price 5.00 marks to Germans). *Geschichte der Elementar-Mathematik* by J. TROPFKE, 2. vermehrte Auflage, Band 2: *Die allgemeine Arithmetik* (Berlin, V.W.V., 1921; 4 + 221 pages; price 50 marks to Germans).

The Institute of International Education was established in February, 1919, by the Carnegie Endowment for International Peace "to develop international good will by means of educational agencies, and for its specific purpose to act as a clearing house of information and advice for Americans concerning things educational in foreign countries and for foreigners concerning things educational in the United States." The administrative board selected to determine and guide the policy of the Institute consisted of "representatives of the endowed and the state universities, of the men's and women's colleges, and of international scholarship, law, finance, commerce, medicine, and journalism."

¹ Abteilung 1—*Reelle Zahlen und Zahlenfolgen* (1916, 12 + 292 pages; price 33.50 marks), Abteilung 2—*Unendliche Reihen mit reellen Gliedern* (1916, 8 + 22 pages; price 31.00 marks).

One of the results of the Institute's organization has been the arrangement for visits to this country of many foreign scholars and professors, and for our professors to lecture in foreign universities. Since the Institute pays travelling expenses both ways the arrangement may obviously be a happy one for those on sabbatic leave. In 1920-21 grants were made to 17 American professors to lecture in 9 countries: Argentina, Bohemia, China, England, France, Greece, Italy, Spain, and Turkey. The only mathematician was Professor SOLOMON LEFSCHETZ, of the University of Kansas, who lectured at the University of Rome. The Institute's *Annual Report*, of February 15, 1921, states that Doctor E. A. HORNE, professor of mathematics at the University of Patna, Patna, India, has been invited to this country by Harvard University.

Some publications of the Institute will be found invaluable for American students in certain foreign countries. We have already noticed the notable monograph of Kenneth McKenzie on *Opportunities for Higher Education in Italy* (61 pages; see 1919, 300-301). There are also: *Opportunities for Higher Education in France* (148 pages), and G. E. MacLean's *Opportunities for Graduate Study in the British Isles* (40 pages). The *Guide Book for Foreign Students in the United States* (published July 1, 1921; 100 pages) will also be of interest to college teachers. Another similar bulletin, just published by the Bureau of Education, Washington (Bulletin, 1921, no. 6), is entitled: *Opportunities for Study at American Graduate Schools* (59 pages).

ARTICLES IN CURRENT PERIODICALS.

AMERICAN JOURNAL OF MATHEMATICS, volume 43, no. 2, April, 1921: "Boundary value and expansion problems: algebraic basis of the theory" by R. D. Carmichael, 69-101; "Algebraic theory of the expressibility of cubic forms as determinants, with application to Diophantine analysis" by L. E. Dickson, 102-125; "The impossibility of Einstein fields immersed in flat space of five dimensions" by E. Kasner, 126-129; "Finite representation of the solar gravitational field in flat space of six dimensions" by E. Kasner, 130-133; "On the motion of two spheroids in an infinite liquid along their common axis of revolution" by B. Datta, 134-142.

BULLETIN OF THE AMERICAN MATHEMATICAL SOCIETY, volume 27, May, 1921: "The February meeting of the American Mathematical Society" by R. G. D. Richardson, 341-351; "Note on equal continuity" by J. F. Ritt, 351-353; "A new method in Diophantine analysis" by L. E. Dickson, 353-365; "The transformation of elliptic integrals" by J. H. McDonald, 366-373; "Bachmann on Fermat's last theorem" by H. S. Vandiver, 373-376 [Review of *Das Fermatproblem in seiner bisherigen Entwicklung* (Berlin and Leipzig, 1919)]; "Two books about airplanes" by E. W. Brown, 377-381 [Review of E. B. Wilson's *Aeronautics: A class text* (New York) and of H. G. Bader's *Grundlagen der Flugtechnik: Entwerfen und Berechnung von Flugzeugen* (Berlin)]; Review by F. M. Morgan of E. Beutel's *Die Quadratur des Kreises* (Leipzig and Berlin, 1920), 382; Notes, 383-386; New Publications, 386-388.

MATHEMATICAL GAZETTE, volume 10, March, 1921: "Address on relativity" by A. S. Eddington, 228-233; "The teaching of mathematics to boys whose chief interests are non-mathematical" by S. H. Clarke, 234-238; "The early history of the Association, or the passing of Euclid from our schools and universities and how it came about" by J. M. Wilson, 239-244; "Further reminiscences" by A. A. Bourne and F. S. Marshall, 244-247; "Mathematics in the lycées" by E. M. Read, 248-254—May, 1921: "Aeroplane mathematics" by S. Brodetsky, 257-281; "Gleanings far and near," 281; Reviews, 282-288 [review of T. Muir's *The Theory of Determinants in the Historical Order of Development*, vol. 3; etc.].

MATHEMATICS TEACHER, volume 14, no. 2, February, 1921: "Outstanding pedagogical principles now functioning in high-school mathematics" by G. W. Myers, 57-63; "The geometry of the junior high school" by J. C. Brown, 64-70; "Algebraic magic squares" by H. P. McLaughlin, 71-77; "The outlook with regard to school mathematics" by W. P. Webber, 78-84; "Mathe-